DOCUMENT RESUME

ED 088 417	IR 000 227

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TITLE	Toward a Theoretical Model of Learning As It Relates To Simulation Games With Discussion.
PUB DATE	74
NOTE	15p.
EDRS PRICE	MF-$0.75 HC-$1.50
DESCRIPTORS	*Discussion (Teaching Technique); Discussion Experience; *Educational Games; Educational Research; Games; Hypothesis Testing; Learning; *Learning Theories; Models; Research Design; *Research Methodology; Research Proposals; *Simulation

ABSTRACT

In order for research on the educational utility of simultation games to advance, there must be some stipulation of a set of significant variables. This, in turn, requires the building of testable theoretical models and the formulation of strategic propositions to test their validity. An example of the process involved is as follows. Focusing upon the domain of what people learn at the cognitive and affective levels from participating in a simulation game with a discussion component, one can identify the four major attributes of: individuals, group participation, simulation game-with-discussion, and learning outcomes. Specific variables within each of these attributes can be identified and laws of interaction devised, such as that learning variables are dependent upon game-with-discussion variables. Strategic propositions are thus generated; e.g., that participants in game-with-discussion demonstrate higher cognitive learning outcomes than participants in games-without-discussions. Specific hypotheses can then be devised and tested; for example, that subjects experiencing games-with-discussion will score higher on an immediate true-false posttest of knowledge of the game, than will subjects who experienced the game without discussion. (PB)

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TOWARD A THEORETICAL MODEL OF LEARNING AS IT RELATES TO SIMULATION GAMES WITH DISCUSSION

by

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1974

Simulation games designed and used for educational objectives have been in existence less than a decade. Research with regard to the learning impact of games is also less than a decade old. Thus far the research seems to be in a "shot-gun" stage. Researchers seem to be trying to look at everything. One of the problems with the present status of simulation game research is that very few of the studies are rooted in a solid conceptual framework. Before game research can advance rapidly, there must be some stipulation of a set of variables that are important and have some priority in terms of further investigation. For such stipulation to take place researchers of simulation games in educational settings must take seriously the task of building testable theoretical models. Through such a theory building process researchers can identify the strategic variables through formulating strategic propositions to test the validity of the model.

The purpose of this paper is to systematically approach the task of theory building as it relates to simulation games in educational settings. The domain of the theory will be described; the theory will be partially developed and discussed in light of previous research; hypotheses will be set forth for a proposed experimental investigation.

The Theory Domain

Some students of simulation games suggest that discussion of a given game experience is necessary in order to maximize learning outcomes (Boocock & Schild, 1968; Harry, 1969; Shirts, 1970; Abt, 1968). At present no testable theory exists which might predict higher learning outcomes as a result of combining simulation games and discussion into a single learning experience.

However, discussion is commonly used with simulation games, but it is not known what effect this combination of teaching methodologies has upon learning outcomes (Fletcher, 1969).

The theory under consideration for this paper, then, is focused on learning as it relates to simulation games linked with a discussion component. Specifically, the theoretical domain is concerned with what people learn at the cognitive and affective level from participating in a simulation game with a discussion component. Hence, the theoretical domain is cognitive and affective learning outcomes of individuals who participate in a simulation game with a discussion component.

Critical Definitions

Critical to understanding the theory as it is set forth in the following pages is the establishment of some basic definitions. Cognitive learning outcomes refer to changes in a student's behavior at the intellectual level, such as knowledge, understanding, and thinking skills. For a complete classification scheme of cognitive learning outcomes at the behavioral level one should see Bloom (1956). Affective learning outcomes refer to changes in a student's behavior at the feeling and emotion level, such as interests, attitudes, appreciation, and methods of adjustment. For a detailed treatment of the affective domain of learning one should see the handbook by Krathwohl (1964). A simulation game is an educational technology used to operationalize a given social process into a dynamic process with gaming and/or role-playing components. Discussion is defined as a small face-to-face group that uses the speech-communication process for individual learning.

Attributes of the Theory

In order for a theory to exist certain units must always be present. Such units are known as attributes. If a given unit is real rather than nominal, it can be measured by some empirical indicator/s. Units can also be classified into varying kinds of units, e.g. enumerative, associative, relational, and statistical (Cf., Dubin, 1969). The attributes of a theory of learning as it relates to simulation games with a discussion component are as follows along with their appropriate unit classification and empirical indicators:

ATTRIBUTES	CLASSIFICATION	INDICATOR
1. Individuals in groups	(E)	By count
2. Simulation game with a discussion component	(E)	By judges' observation and report
3. Group participation	(E)	By self-report, scaled questionnaires, and/or observers' reports
4. Learning outcomes	(E)	By achievement tests, scaled items, strategy development procedures, etc.

In addition to the attribute units which are essential to the essence of the theory, there are other units which may be present in varying degree. These units are known as variables. Below are listed a number of learning outcome variables, simulation game variables, discussion variables, and individual variables that might be relevant to a theory of learning relating simulation games with discussion. Along with the list of variables is an appropriate classification of the units and their empirical indicators.

LEARNING OUTCOME VARIABLES	CLASSIFICATION	INDICATOR
1. Cognitive	(E)	By tests designed to test Bloom's (1956) categories
2. Affective	(E)	By tests designed to test Krathwohl's (1964)

		categories
3. Duration of outcomes	(E)	By tests given at various points in time following a learning experience

GAME VARIABLES	CLASSIFICATION	INDICATOR
1. Type of game	(E)	By a classification of games
2. Subject matter of the game	(E)	By game designer/s
3. Complexity of the model on which the game is based	(E)	By a classification system and game designer
4. Fidelity of game to model	(R)	By validity tests
5. Fidelity of model to reality	(R)	By validity tests
6. Type/s of learning objectives	(E)	By game designer/s or judges
7. Multidimensionality of objectives	(E)	By game designer/s or judges
8. Learning design behind the simulation game	(E)	By game designer/s or judges
9. Time length of game	(E)	By minutes
10. Number of game periods	(E)	By counting
11. Game instructions	(E)	By analysis of instruction format by judges
12. Goals--learner controlled or fixed	(E)	By game designer/s or judges
13. Game administrator/s	(A)	By counting
14. Game administrator's role	(A)	By observer's report
15. Prompting in the game	(A)	By frequency count by observer
16. Degree of rule structure	(E)	By judges' opinions
17. Complexity of game apparatus	(E)	By count of items by judges

18.	Degree of difficulty in acquiring winning strategy	(E)	By judges' ratings
19.	Amount of skill required to win	(E)	By judges' ratings
20.	Number of decisions to be made	(E)	By frequency count
21.	Role-playing component	(A)	By game design
22.	Final score	(A)	By whether or not losers and winners are announced
23.	Game climate	(E)	By scaled items by participants and/or observers
24.	Interlinkage of a simulation game with a discussion component	(R)	By learning design of the game administrator
25.	Number of players	(E)	By counting
26.	Composition of team in terms of age, sex, ability, etc.	(E)	By demographic data
27.	Feedback processes	(A)	By game design

	DISCUSSION VARIABLES	CLASSIFICATION	INDICATOR
1.	Method of discussion	(E)	By a classification system
2.	Discussion time	(E)	By minutes
3.	Facilitator	(A)	By whether or not one is used.
4.	Facilitator style	(A)	By classification system and/or observers' reports
5.	Group climate	(E)	By scaled items by participants and/or observers
6.	Interlinkage of simulation game with discussion component	(R)	By learning design of the game administrator
7.	Competence of facilitator	(A)	By amount of training and/or judges' evaluation

8.	Number of discussants	(E)	Indicated by count
9.	Composition of groups in terms of age, sex, and ability, etc.	(E)	Indicated by demographic data

	INDIVIDUAL VARIABLES	CLASSIFICATION	INDICATOR
1.	Age	(E)	By self-report of age
2.	Sex	(E)	By self-report of sex
3.	SES	(E)	By Hollingshead's (1958) classifications
4.	Cultural background	(E)	By self-report data
5.	Intelligence	(E)	By I. Q. Scores
6.	Educational background	(E)	By self-report data
7.	Predisposition toward game and discussion techniques	(E)	By scaled items
8.	Previous game experience	(A)	By self report
9.	Previous discussion experience	(A)	By self report
10.	Previous relationship of players	(A)	By number of previous contacts related in self report data
11.	Amount of individual participation in game	(A)	By scaled self report and/or observers' reports
12.	Amount of individual participation in discussion	(A)	By counting utterances and/or observers' reports
13.	Varying levels of game understanding	(A)	By game strategy score
14.	Belief in control of game destiny	(A)	By self-report scaled items

Laws of Interaction

Laws of interaction are devised by stating the relationship between two or more units. By examing the various possibilities for combining units into laws of interaction one can readily see that a list of such laws could be quite lengthy. A development of such a list would be useful for a refinement of the theory and for developing a wide range of testable hypotheses directly related to the model. However, it would seem that a more strategic and powerful research approach at this point in the development of the theory would be to lump together various variables and relate them to each other. It seems quite logical to state the following laws on the basis of this reasoning:

1. Learning outcome variables are highly dependent upon game variables.
2. Learning outcome variables are highly dependent upon discussion variables.
3. Learning outcome variables are highly dependent upon individual variables.

Previous research in various fields has investigated to a great extent the relationship between learning variables and individual variables (Cf., Carroll, 1963; McKeachie, 1963). Research has also been done relating learning outcomes to simulation game variables (Cf., Boocock & Schild, 1968; Cherryholmes, 1966; Twelker, 1969). The relationship between learning outcomes and discussion has been investigated (Cf., Dicken & Heffernan, 1949; McKeachie, 1963; Larson, in press; Wallen & Travers, 1963; Dubin & Taveggia, 1968). Previous research has studied learning outcome variables and individual variables as they relate to simulation game variables (Inbar, 1968; Fletcher, 1969) or discussion variables (Cf., McKeachie, 1963). Left untested are laws which relate learning outcome variables and individual variables both to simulation game variables and to discussion variables. Such a law could be stated as follows:

4. Learning outcome variables are highly dependent upon game variables, discussion variables, and individual variables.

By controlling individual variables through random sampling and the use of a predisposition indicator toward teaching methodologies in a given research study the above law could be restated:

Learning outcome variables are highly dependent upon game variables and discussion variables.

A Strategic Proposition

Growing out of the above law of interaction might be the following strategic proposition:

Subjects who participate in a simulation game with a discussion component will, immediately following the learning experience, demonstrate higher learning outcomes at the cognitive and affective levels than will subjects participating in simulation without discussion, discussion without game play, or neither.

In testing the strategic proposition several of the unit variables mentioned above have to be taken into account in setting up a research design, e.g. the game instructions, facilitator style, method of discussion, game time, discussion time, etc. The simulation game chosen for the study often determines many of the game variables being taken into account.

The type of research suggested by the strategic proposition fits within the classical educational research designs utilized for comparing various educational methodologies. The weakness of much of this research is that it does not take into account the various variables of a given teaching methodology when the results are interpreted. For example, discussion in one research setting is quite different from discussion in another setting. One discussion group may have eight members; whereas, another group may have thirty members. Does this group composition variable affect learning outcomes? Can research results based upon groups of thirty be generalized to groups of eight? The theory of learning developed for simulation games with discussion helps the researcher to take into account these various variables in his design and in the interpretation of his statistical results.

Hypotheses

The following hypotheses are designed to test aspects of the above proposition. They are not designed to test the full measure of the proposition. Other hypotheses could be generated from this proposition, but the hypotheses below are related to a proposed study (Chartier, 1971). The hypotheses stated below are concerned with measuring the depth of cognitive learning outcomes gained by a subject in a given learning experience. The testing procedures have been designed according to the taxonomy of educational objectives set forth in Bloom (1956). Cognitive learning outcomes in a descending order from simple to complex levels are knowledge, comprehension, application, analysis, synthesis, and evaluation. The testing procedures indicated in the hypotheses do not measure the full range of each of these cognitive learning outcomes but attempts to sample the learnings from each level of the hierarchical order. Only one hypothesis is concerned with the affective level. The affective domain of the taxonomy of educational objectives has a hierarchial pattern descending from receiving to responding, to valuing, to organization, and finally to characterization by a value or value complex. The affective hypothesis is designed to measure a low order affective outcome which is responding. The range of this outcome is narrowly focused into measuring a satisfaction response which is a standard measuring outcome in small group research.

The hypotheses are designed to gather evidence to support or to negate the concern of the simulation game educators that discussion may be used to maximize the cognitive learning outcomes of games (Boocock & Schild, 1968). It could be that the significant learning outcome among the four experimental conditions suggested by the proposition and the hypotheses is the satisfaction level among varying experimental learning conditions.

The hypotheses growing from the strategic proposition also measure outcomes immediately following the learning experiences. Such measurements could be made at various points in time after the learning experience to test for the retention of learning. The strategic proposition and the hypotheses that grow out of it are designed to see if any significant differences among experimental learning conditions can be replicated across subjects in a given condition. Future research would be concerned about retention of learnings if the present hypotheses can be supported by research data.

In order to test the strategic proposition the following hypotheses are offered:

1) Subjects experiencing Generation Gap with an instrumented discussion component immediately following the learning experience will score higher on a true-false test of knowledge about the game than will subjects experiencing the simulation game without instrumented discussion, instrumented discussion without game play, or neither.
2) Subjects experiencing Generation Gap with an instrumented discussion component immediately following the learning experience will score higher on a multiple-choice test of comprehension about the game than will subjects experiencing the simulation game without instrumented discussion, instrumented discussion without game play, or neither.
3) Subjects experiencing Generation Gap with an instrumented discussion component will be able to apply material learned through discussion in changed game conditions by progressing more rapidly toward the rational strategy of the game than will subjects experiencing the simulation game

without instrumented discussion. This hypothesis is only relevant to the simulation game with instrumented discussion component and the simulation game without instrumented discussion experimental conditions.

4) Subjects experiencing Generation Gap with an instrumented discussion component will score higher on a multiple-choice test of game analysis than will subjects experiencing the simulation game without instrumented discussion, instrumented discussion without game play, or neither.

5) Subjects experiencing Generation Gap with an instrumented discussion component will score higher on a multiple-choice test of synthesis than will subjects experiencing the simulation game without instrumented discussion, instrumented discussion without game play, or neither.

6) Subjects experiencing Generation Gap with an instrumented discussion component will score higher on a multiple-choice test of evaluation than will subjects experiencing the simulation game without instrumented discussion, instrumented discussion without game play, or neither.

7) Subjects experiencing Generation Gap with an instrumented discussion component will express a higher satisfaction response on a 20 item rating scale than will subjects experiencing the simulation game without instrumented discussion, instrumented discussion without game play, or neither.

In summary, an attempt has been made to work toward a theory of learning related to simulation games with discussion. The theoretical domain has been identified, attributes and variables have been listed with appropriate classifications and indicators, integrating laws of interaction have been formulated, a strategic proposition has been stated, and hypotheses for a given study have been indicated. Research results will provide the necessary feedback for further development of the theory.

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